

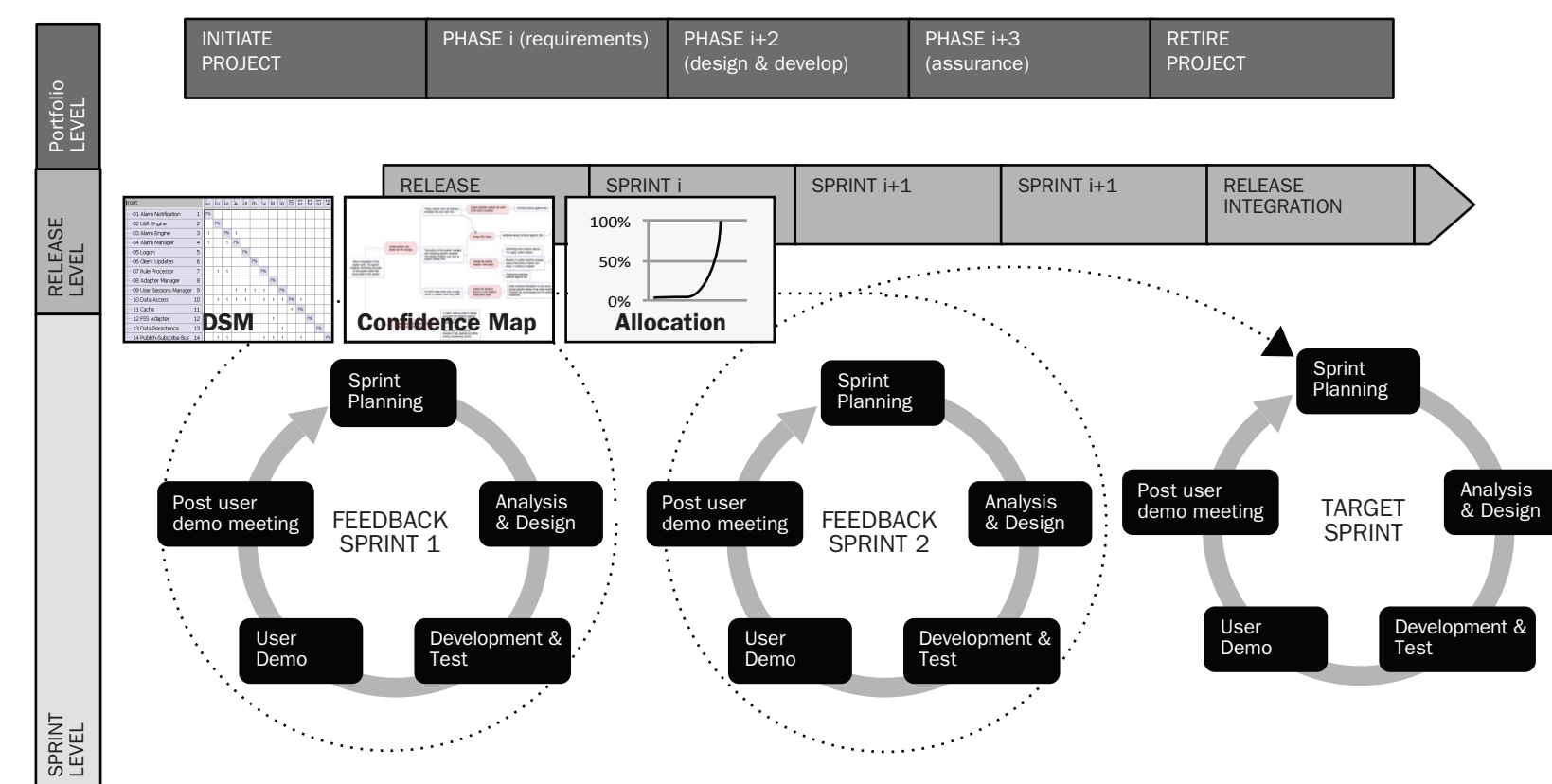
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# Value-Driven Incremental Development

## Integrating Architecture Analysis and Assurance With Development

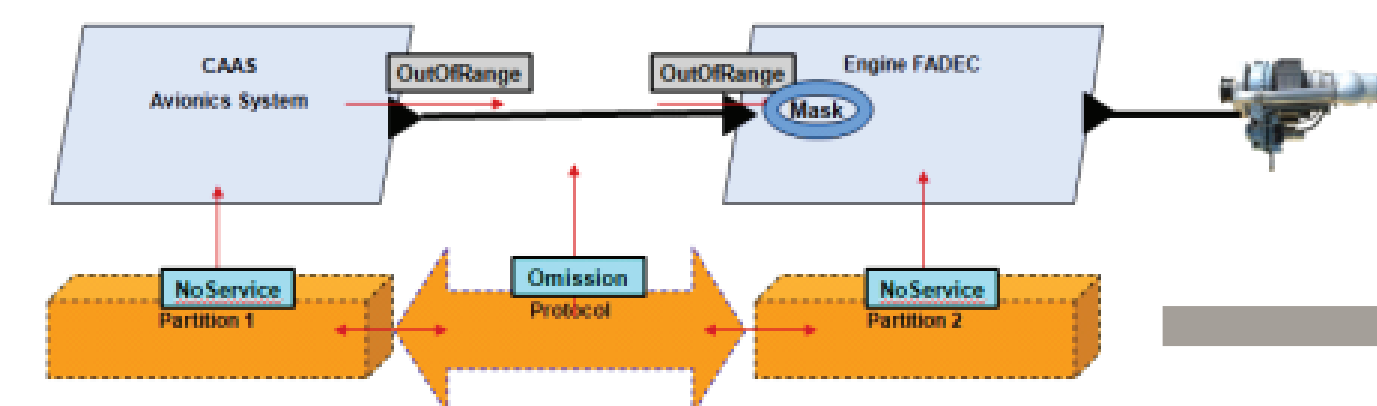
### Objective

Investigate how quality attribute requirement allocation and dependency analysis inform incremental development and assurance through managing rework during development.



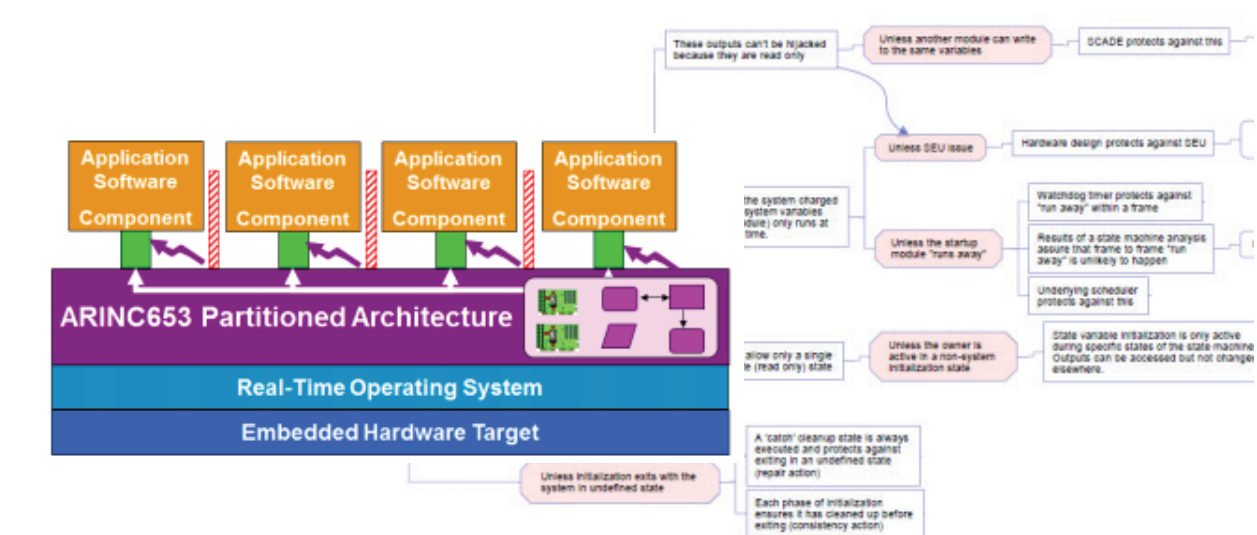
### Multi-dimensional Analysis

What is the design implication of a release decision?



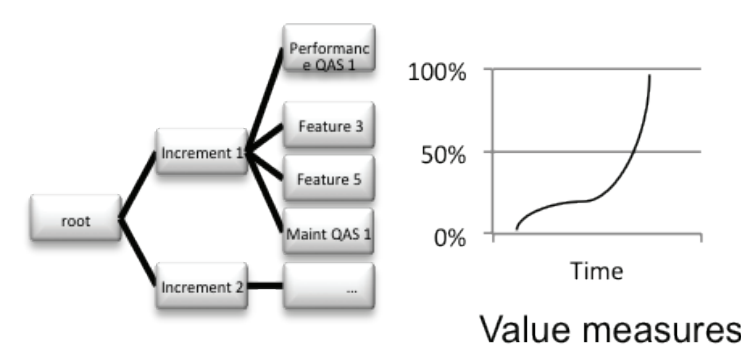
### Architecting for Incremental Assurance

What are the assurance implications of a release decision?



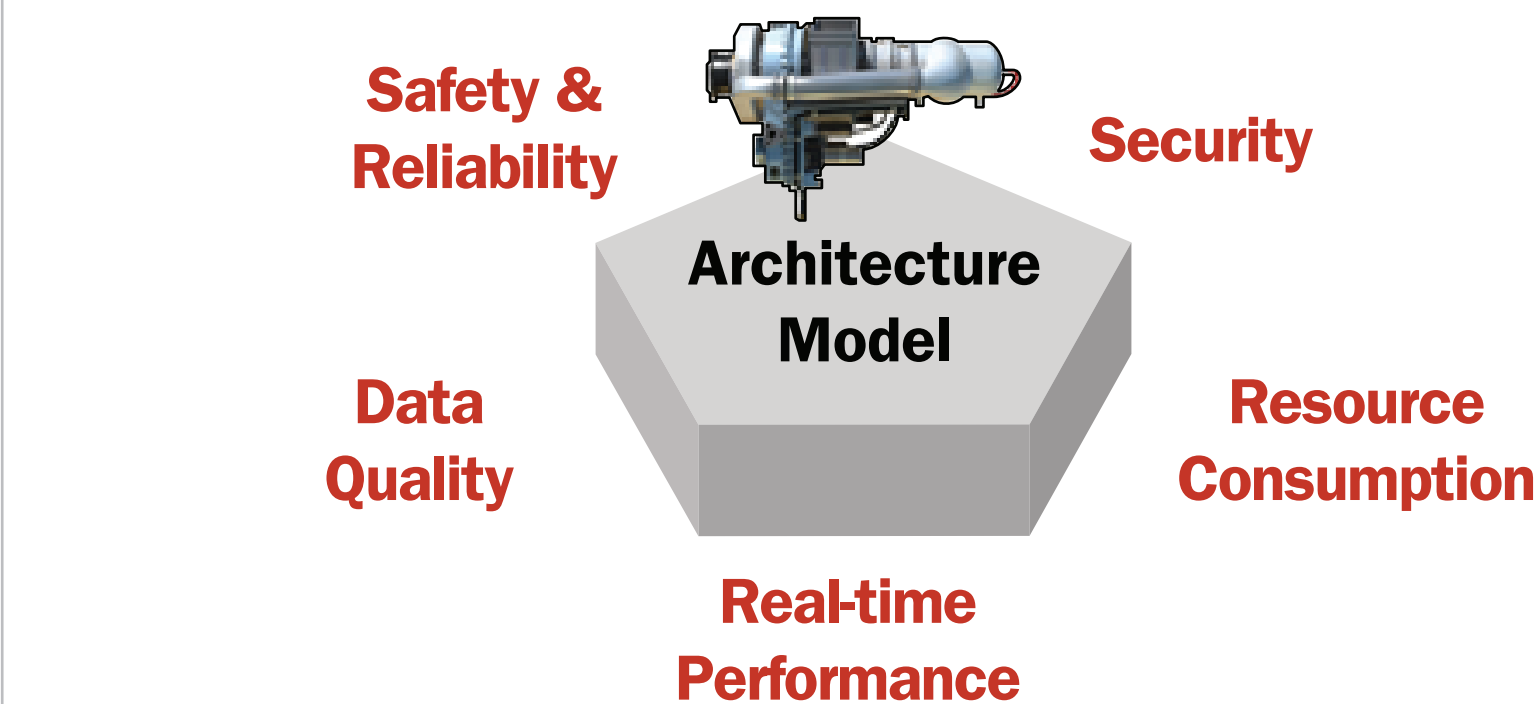
### Quality Attribute Allocation

How do we break architectural features into increments; what measures are needed to make good release decisions?



### Solution Approach

- Collect quality attribute requirements using architecture-tactics questionnaires
- Create models for deployment view augmented with partitioning and fault-tolerance information
- Generate an experiment environment where models can be seamlessly exchanged
- Apply modifiability and fault-propagation metrics
- Validate that augmenting with fault-tolerance information provides information about propagating rework
- Validate whether incremental-assurance information can be contained within architecture changes

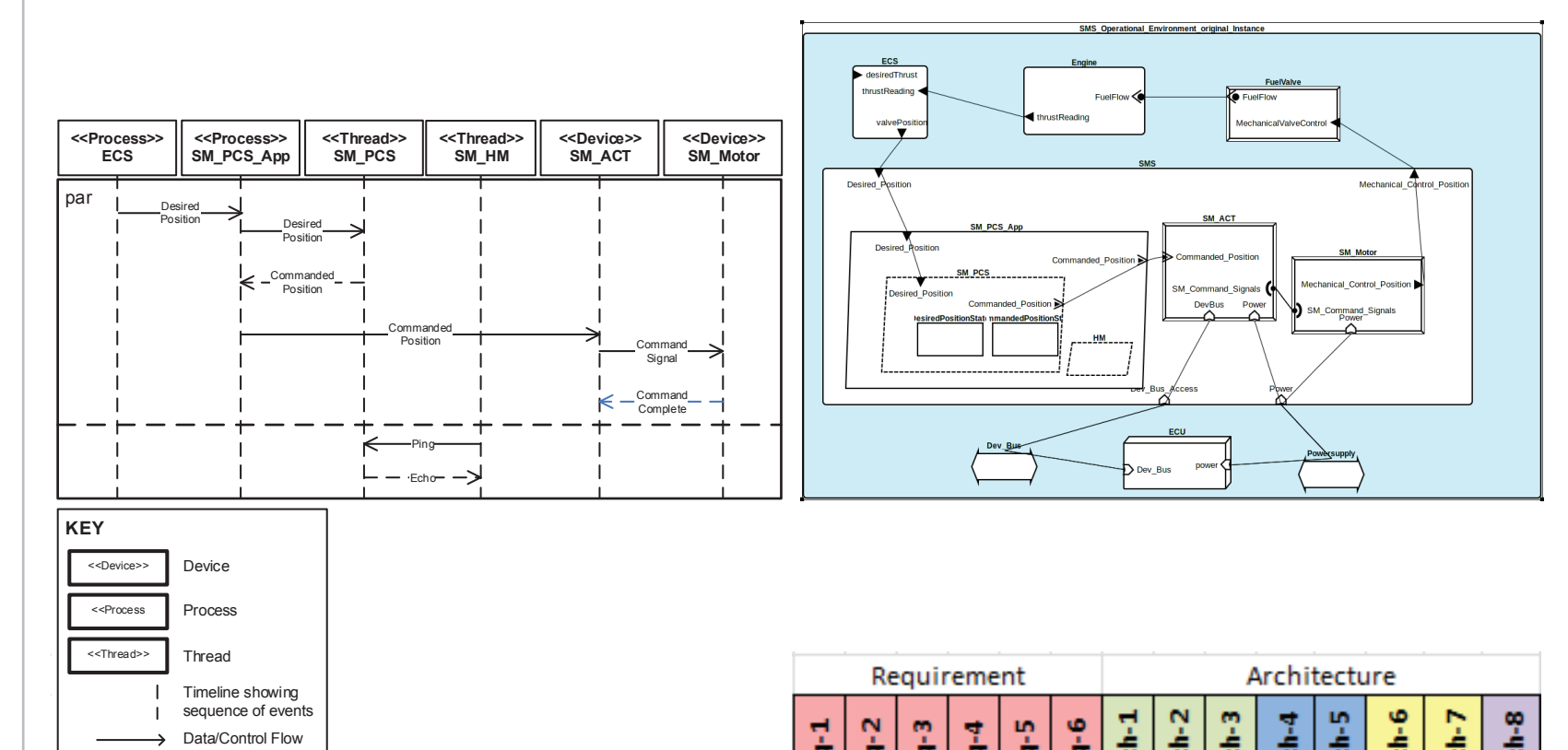


		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NAV	1	LTa							LS							
COMM	2		LTc						LS							
USM	3			LTc					LS							
SU1	4				LTc					LS						
SU2	5					LTc					LS					
SU3	6						LTc					LS				
CND_M	7							LTc	SR	SR	SR	SR	SR	SR	SR	SR
IMC_D	8	LD							SR	LTa						SR
COMM_D	9		LD						SR		LTc					SR
USM_D	10			LD								LTc				SR
SU1_D	11				LD								LTc			SR
SU2_D	12					LD								LTc		SR
SU3_D	13						LD			SR						
REND	14								SR	SR	SR	SR	SR	SR	SR	LTb
Comp. Impl. Layer	15	c	c	c	c	c	c	c	c	c	c	c	c	c	c	Tc

### Multi-Dimensional Analysis Drives Increment Value Assessment

### Selected FY14 Results

- Improved rework analysis by making **architectural dependency** information (e.g., fault-propagation dependencies) available to developers during architecture modeling and development
- Eliminative argumentation** defined as a core concept that is a basis for arguing confidence and in establishing the theory of confidence
- Incremental evolution of **quality attribute requirement allocation** using architecture tactics-based data collection occurs through small refinements and ratcheting of response measures. Empirical studies and surveys with organizations revealed architectural rework occurs in such context and can be managed by better quantification of technical debt.



	Requirement						Architecture							
	SMS-Req-1	SMS-Req-2	SMS-Req-3	SMS-Req-4	SMS-Req-5	SMS-Req-6	SMS-Arch-1	SMS-Arch-2	SMS-Arch-3	SMS-Arch-4	SMS-Arch-5	SMS-Arch-6	SMS-Arch-7	SMS-Arch-8
SMS-Req-1: desired position		1												
SMS-Req-2: actual position								1						
SMS-Req-3: actual and commanded positions									1	1			1	
SMS-Req-4: command completion											1	1		
SMS-Req-5: command duration												1	1	
SMS-Req-6: response delay													1	1
SMS-Arch-1: SMS.SM_PCS														
SMS-Arch-2: SMS.SM_PCS.DesiredPositionState								D	A					A
SMS-Arch-3: SMS.SM_PCS.CommandedPositionState								D	A					A
SMS-Arch-4: SMS.SM_ACT								S					CD	
SMS-Arch-5: SMS.SM_ACT.StepsToDo										D				
SMS-Arch-6: SMS.SM_MOTOR										S				
SMS-Arch-7: SMS.SM_MOTOR.ActualPositionState									A	A			D	
SMS-Arch-8: SMS.SM_HM											LP			

Multi-view analysis allows developers to see different types of dependencies that need to be investigated when changes occur

### Collaborators

Carnegie Mellon University, Clemson University, University of British Columbia, University of Pennsylvania, DoD and industry partners

